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Plant Species Recognition Skills in Finnish Students and Teachers

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Abstract: Limited awareness about nature and its species can have a negative influence on children's relationship to nature. Plant species recognition and outdoor education are perhaps the easiest way to approach nature relationships and increase knowledge. Unfortunately, it has been shown that people do not recognize plant species very well. This phenomenon is called "plant blindness". This study presents information about the phenomenon in Finland. The purpose of this research was to determine how well Finnish students from different age groups recognize plant species and which variables explain recognition of plant species in general education in Finland. The subjects were pupils from primary school to university teachers. A total of 754 people took part in the research. The results showed that Finnish pupils do not recognize plant species very well, with wide variations in responses between student levels. Species recognition skills improved from primary school to university teachers.

Keywords: plant species recognition; plant blindness; outdoor education

1. Introduction

Plant species can be found everywhere, and people are surrounded by them. However, it has been shown that people do not recognize plant species very well. Wandersee and Schussler [1,2] started to refer to this phenomenon as "plant blindness". They defined it as a lack of awareness of plants. More specifically, plant blindness is the inability to see or notice the plants in one's own environment; the inability to recognize the importance of plants in the biosphere and in human affairs; the inability to appreciate the aesthetic and unique biological features of plants; and the misguided, anthropocentric ranking of plants as inferior to animals, leading to the erroneous conclusion that they are unworthy of human consideration [1]. This has serious effects on plant conservation [3], and it is alarming if people do not know the processes essential for life on our planet [4]. At the same time, almost 45% of plant species in Europe are under the threat of extinction [5], and in Finland this number is nearly 28% [6]. We are facing many environmental problems, including climate change, invasive plant species, and pollution of the environment. Without the ability to see the plant species and without an understanding of the meaning of the plants, it is hard to protect them or to understand how ecosystems and nature work. In this era of the digital world, many children have not walked in "real nature" [7]. It has been shown that having a limited connection to nature can have a negative influence on children's environmental behavior [8,9]. Having a good relationship with nature is the key element when you want someone to understand and protect nature [10–14]. Pany [4] has listed several studies which concern plant blindness.

A person who has "plant blindness" may have symptoms including the following: (a) Failing to see, take notice of, or focus attention on plants in one's daily life; (b) thinking that plants are merely the backdrop for animal life; (c) misunderstanding the kinds of matter and energy plants require to stay alive; (d) overlooking the importance of plants in one's daily affairs; (e) failing to distinguish between the differing timescales of plant and animal activity; (f) lacking hands-on experience in growing, observing, and identifying plants in one's own geographic region; (g) failing to explain basic plant science underlying nearby plant communities—including plant growth, nutrition, reproduction, and relevant ecological considerations; (h) lacking awareness that plants are central to a key biogeochemical cycle—the carbon cycle; and (i) being insensitive to the aesthetic qualities of plants and their structures—especially with respect to their adaptations, coevolution, colors, dispersal, diversity, growth habits, scents, sizes, sounds, spacing, strength, symmetry, tactility, tastes, and textures [1,2].

Concepts such as zoocentrism, zoochauvinism [15,16], and plant neglect are used when trying to describe this phenomenon. Why people often overlook plants and are much keener on animals has been investigated. Humans do not pay attention to stimuli not meaningful to them [17]. In this context, plant species can be a low signal value stimulus, because they seem to be safe and do not run or attack. This perception is connected to human evolution because most people are no longer in direct danger from plants; therefore, plants are less noticed [18]. If an observer assigns meaning to an object, the observer is more likely to perceive it. An example of this is the common nettle plant. Most people have touched a nettle and, after an unpleasant experience, most notice nettles better and want to avoid them. According to Baddeley [17,19], humans are quite poor at recalling the details of the objects we see or use daily. It has also been claimed that plant blindness is due to schooling and biology lessons [4,20]. Teachers seems to use animals as examples in explaining evolution [15,21], and many biology school books are full of animals, but not so many consider plant species [22].

One way to improve the plant blindness situation is to go outdoors to see real plant species. If there are no older images and memories about plant species, they are hard to identify [23–29]. When humans perceive plants, it is a cognitive, complex process, which is connected to other cognitive processes like memory, learning, thinking, language, emotions, and motivation [30]. Perception seeks to identify the object and sensation, and older experiences and psychological efficiency can lead perception [23]. Many researchers have similar ideas about perception—perception requires the observed image to be compared to memory images. It is easier to recall memories if they are stored through several senses and so they create nets and links to each other [31,32]. Outdoor education can be also motivating [33–36], and good motivation helps pupils to learn [37]. It has been shown that going outdoors increases students' knowledge of and attitudes to plants [38]. Going outdoors also helps with children's physical wellness and can protect children from many sicknesses, including atopy. When children are connected to nature, their immune defenses grow: The so-called biodiversity hypothesis [39]. It is also important for children to experience that nature can be a place to relax and freshen up and to get feelings of happiness and joy. As many as 80% of Finnish people feel that forests and green environments affect their living comfort positively and almost 50% says that their favorite place is situated in forests [40]. Gardening and plant species are used as therapy [41,42]. Feelings of security can also increase when children start to recognize the impact of nature and its components on their nearest living environments [7].

There are also other arguments which encourage the teaching of plant species recognition. Many professions are connected to nature. More than 50% of the medicines we use come from compounds from plant species, and new medical plants are being searched for all the time [43–45]. There are strong recommendations for the vegetarian diet [46]. Picking wild vegetables from the woods is quite popular in Finland. In such cases, it is important to know what to eat, because there are many toxic plant species which should be recognized. A considerable amount of research has revealed the meaning of being and walking outdoors [7,36,40,47–49]. It has been pointed out that both physical and emotional effects, like stress hormone levels, pulse rate, and blood pressure are lower even after a few minutes of being outdoors. Feelings of vitality, mood, and cognitive effects rise after 20–40 min of being outdoors [40]. We should also not forget the aesthetic effects on us: Plant or other species recognition may give us joy and happiness. It is one of the things that can help us attain a good quality of life.

The purpose of this research was to determine plant species recognition skills and plant blindness in Finland. Even though the concept of plant blindness is multidimensional, in this article we have concentrated on the knowledge tasks. The research questions were:

(1) How well do Finnish students from different grade levels recognize plant species (with a specific name or the taxonomical group they are a member of)?
(2) Which plant species are well known, and which are not?
(3) Which variables explain recognition of plant species: (a) Gender, (b) grade levels, (c) school grade/level, (d) living place, or (e) school?

2. Materials and Methods

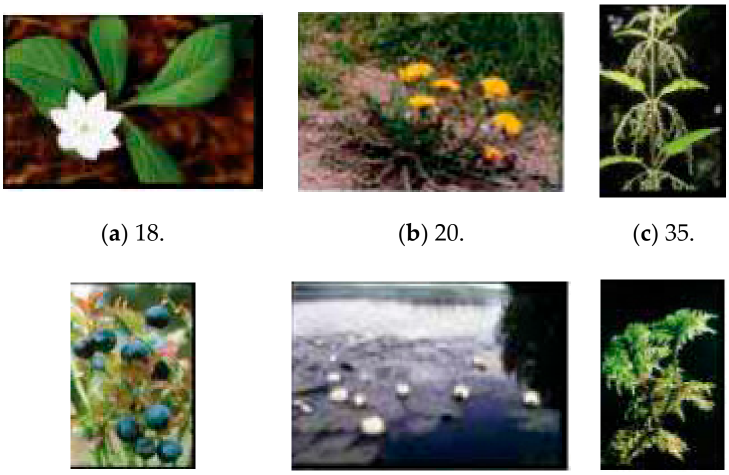
The subjects were pupils from every level of education: Primary school (grades 1–6; number of subjects: 358); lower-secondary school (grades 7–9; number of subjects 139); high school (grades I–II; number of subjects 137); student teachers (103); classroom teachers (6); and teachers from university involved with environmental teaching (11). A total of 754 people took part in the research.

Quantitative research methods were used. The quantitative method was a plant species recognition test, where photographs of 70 plant species (generally found in Finland and in school books) were shown to the subjects. This test was used to get results on the three main research questions (Table 1). Data were analyzed with SPSS software, which is a computer-based statistical analysis program. The statistical methods used are presented in Table 1.

Table 1. Statistical methods used with the SPSS software.

Research Question	Used Statistical Method
1. How well do Finnish pupils and students of different ages recognize plant species (with a name or in a taxonomy level)?	Frequencies Means
2. Which plant species are well known and how plant species are named?	Frequencies
3. Which variables explain plant species recognition statistically significantly: (a) Sex, (b) age, (c) school grade/level, (d) living place, or (e) school?	One-way ANOVA Independent samples test

The plant species shown in the test were selected from school books. They were widely distributed plant species, except for a few of them which are rare. That is how we tried to identify the subjects who are interested in plants. The test included trees, shrubs, and grassy plants, but also some mosses and lichens. Photographs were taking from a school slide collection. The test took 45–60 min. Subjects were asked to write down the common plant species names on a paper form (the Finnish name, not the scientific name). If the name was missing, pupils could write the taxonomy level or other information about the plant. Pupils could also write that they could not remember its name or that they had never seen the plant before. Photographs were shown to the subjects and subjects had up to one minute to write each plant's name on the form. The plant species shown in the test are listed in Appendix A. Here are some examples of the photographs which were shown in the plant species recognition test (Figure 1).



(**a**) 18. (**b**) 20. (**c**) 35.

(**d**) 55. (**e**) 62. (**f**) 66.

Figure 1. Examples of the photographs which were shown in the plant species recognition test: (**a**) Test number 18 = *Trientalis europaea*, European Starflower/Chickweed Wintergreen, (**b**) 20 = *Taraxacum* sp., Dandelion, (**c**) 35 = *Urtica dioica*, Common/Annual nettle, (**d**) 55 = *Vaccinium myrtillus*, Blueberry/Bilberry, (**e**) 62 = *Nymphaea alba/candida*, White water-lily, (**f**) 66 = *Hylocomium splendens*, Glittering feather moss.

3. Results

The results are presented in the order of research questions.

3.1. How Well Do Finnish Pupils and Students of Different Ages Recognize Plant Species (With a Specific Name or in a Taxonomy Level)?

The research results showed that on average, plant species were recognized insufficiently at every level of education. On average, Finnish pupils, students, teachers, and experts (N = 754) recognized 25 of the 70 plant species (36% of species) shown to them (Table 2). They recognized 31 plant species within a taxonomy class (about 44% tested species) (Table 2).

Table 2. Results of plant species recognition test (all subjects from primary, lower secondary, and high school, university department of teacher education, primary school teachers, and experts from university, N = 754). Minimum and maximum number of points and averages in the plant species recognition test. All numbers have been rounded to integers.

School	Number of Subjects	Min [a]	Max [b]	Mean_1 [c]	Per cent_1 [d]	Mean_2 [e]	Per cent_2 [f]
Primary school (grades 1–6, age 6–13)	358	0	47	**19**	27	**23**	33
Lower secondary school (grades 7–9, age 13–16)	139	8	45	**24**	34	**32**	46
High school (grade I–II, age 16–19)	137	9	61	**28**	40	**36**	51
University department of teacher education, student teachers (age 19–40)	103	18	64	**34**	49	**42**	60
Primary school teachers (age 25–60)	6	21	65	**44**	63	**51**	73
Experts from university (age 30–80)	11	41	70	**58**	83	**65**	93
All (from primary school to experts, age 6–80)	754	0	70	**25**	36	**31**	44

Notes: [a] Min = minimum, what is the weakest result in the species recognition test. [b] Max = maximum, what is the best result in the species recognition test. [c] Mean_1 = number of plant species recognized on average. Mean is rounded to an integer. [d] Percent_1 = percentage of plant species recognized. Percentages are rounded to integers. [e] Mean_2 = number of plant species recognized on average in a taxonomy level. Mean is rounded to an integer, [f] Percent_2 = percentage of plant species recognized even in a taxonomy level. Percentage figures have been rounded to the nearest integer.

Primary school pupils (grades 1–6, age 6–13, N = 358) recognized 19 (about 27%) of the 70 plant species shown to them. Lower secondary school pupils (grades 7–9, age 13–16, N = 139) recognized 24 (34%) of the plant species. High school pupils (grades I–II, age 16–19, N = 137) recognized 28 plant species on average (40%). Teacher education students (N = 103) on average recognized 34 (49%) plant species. Primary school teachers (N = 6) recognized 44 (63%) plant species and university teachers and experts (N = 11) on average 58 (83%) plant species.

Finnish pupils, students, teachers, and experts recognized plant species better in a taxonomy class than with specific species name. For example, while primary school pupils recognized 19 plant species with specific names, they could recognize up to 23 plant species within a taxonomy level (Table 2). The result was similar at every subject level. Even if the subject could not recall plant-species-specific names very well, they could recognize plant species in taxonomy classes a little better.

The variations between subjects were large. The best primary school pupil recognized 47 plant species, while the worst did not recognize any species (Table 2). The best pupils from lower secondary school recognized 45 plant species, and the worst only 8 species. Some teachers did not recognize plant species very well either, and the difference was large. While the strongest teacher recognized 65 plant species, the weakest teacher recognized only 21 plant species. All the variations can be seen in Table 2. Overall species recognition skills improved from primary school to university teachers (Figure 2). That is a good sign: Education develops species recognition skills.

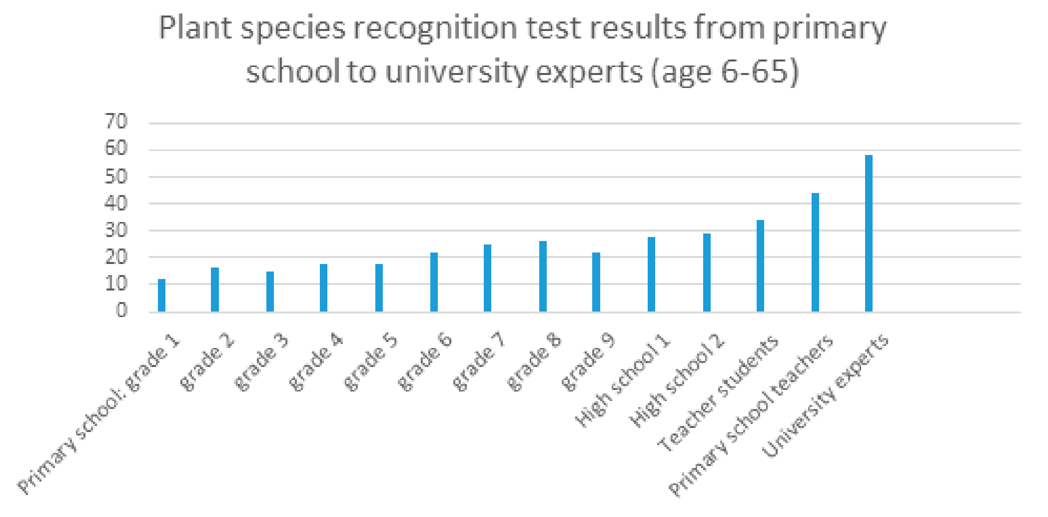


Figure 2. Summary of the results (means) from plant species recognition test from primary school to university experts.

When combining the data, we can see results expressed in larger units. Primary and lower secondary school pupils (grade 1–9, age 6–16, N = 497) recognized 21 (30%) plant species on average. All school pupils (from primary to high school, age 6–19, N = 634) recognized 22 plant species on average (about 31%). Grade 9 results are surprising, because their recognition of plant species was weaker than that of the seventh and eighth graders.

3.2. Which Plant Species Are Well Known and How Are Plant Species Named?

Subjects recognized berries and trees well, but many common herbaceous flowers were not very well known. The best-recognized plant species were raspberry (*Rubus idaeus*), bilberry (*Vaccinium myrtillus*), spruce (*Picea abies*), and Norway maple (*Acer platanoides*) (over 90% of subjects recognized these plant species) (Table 3). Among the ten best-identified plant species were five berries, three trees, and two herbaceous flowers. All the well-known species have clear identification marks, and subjects probably had memories and experiences with them involving many senses. For example, they may have picked and tasted berries, they could have had a spruce Christmas tree, common nettle has burnt their skin, and dandelion is one of the first flowers in the spring and they have collected them and made flower wreaths.

Table 3. Plant species which were recognized well in the species recognition test.

Plant Species	How Many Were Recognized from Among the 754 Subjects?	How Many of the 754 Subjects Did Not Recognize the Plant Species?
Rubus idaeus, raspberry	736 (97.6%)	18 (2.4%)
Vaccinium myrtillus, blueberry/bilberry	725 (96.1%)	29 (3.9%)
Picea abies, spruce	705 (93.5%)	49 (6.5%)
Acer platanoides, Norway maple	691 (91.6%)	64 (8.4%)
Pinus sylvestris, pine	675 (89.1%)	79 (10.5%)
Vaccinium vitis-idaea, rock-cranberry/cowberry	672 (89.1%)	82 (10.9%)
Urtica dioica, common nettle	668 (88.6%)	86 (11.4%)
Taraxacum sp., dandelion	665 (88.2%)	89 (11.8%)
Rubus chamaemorus, baked-apple-berry/cloudberry	630 (83.6%)	124 (16.5%)
Fragaria vesca, wood strawberry	613 (81.3%)	141 (18.7%)

Several plant species were not well known. Among the ten least-recognized plant species were hairy wood rush (*Luzula pilosa*), bird's eye/germander speedwell (*Veronica chamaedrys*), cow-wheat (*Melampyrum pratense*), or common toadflax (*Linaria vulgaris*) (Table 4). Only few subjects recognized them according to a taxonomy level. For example, four subjects did not recognize spotted orchid as a specific name, but they could recognize that it was a type of orchid. The same was the case with yellow vetchling (*Lathyrus pratensis*): Only 18 subjects recognized it by its specific name, but 62 subjects could say that it is a pea. Grey alder is a tree which only 23 subjects recognized, but 197 subjects could say that it is an alder. Many subjects could not recognize these plant species at all.

Table 4. Plant species which were not recognized well in the species recognition test.

Plant Species	How Many Were Recognized from Among the 754 Subjects?	Taxonomy Level Which Subjects Could Classify	How Many Subjects Recognized Only the Taxonomy Level?	How Many of the 754 Subjects Did Not Recognize the Plant Species by Specific Name Either?
Luzula pilosa, hairy wood rush	8 (1.1%)	-	-	746 (98.9%)
Veronica chamaedrys, bird's eye/germander speedwell	9 (1.2%)	Speedwell	9 (1.2%)	736 (97.6%)
Melampyrum pratense, cow-wheat	11 (1.5%)	Melampyrum	8 (1.1%)	735 (97.5%)
Linaria vulgaris, butter-and-eggs/common toadflax	15 (2.0%)	-	-	739 (98.0%)
Dactylorhiza maculata, spotted orchid	17 (2.3%)	Orchid	4 (0.5%)	733 (97.2%)
Lathyrus pratensis, yellow vetchling	18 (2.4%)	Lathyrus/pea	62 (8.2%)	674 (89.4%)
Galeopsis speciosa, hemp-nettle	19 (2.5%)	Galeopsis	10 (1.3%)	725 (96.2%)
Geranium sylvaticum, wood cranesbill	20 (2.7%)	Geranium	19 (2.5%)	715 (94.8%)
Alnus incana, grey alder	23 (3.1%)	Alder	197 (26.1%)	534 (70.8%)
Daphne mezereum, daphne	26 (3.5%)	-	-	728 (96.6%)

Some of these plants are species which do not have very visible identification marks, like hairy wood rush, but germander speedwell, cow-wheat, or common toadflax have easy-to-see identification marks.

There were plant species that subjects could recognize better according to a taxonomy level than with a specific name. For example, silver birch trees were better recognized as a birch than according to a specific name. The same situation occurred with bracken. Only 39 subjects knew the exact name, but 384 subjects could classify it according to its taxonomy level. All those plant species are presented in Table 5.

Table 5. Plant species that were recognized better in a taxonomy level than by specific name.

Plant Species	How Many Were Recognized from Among the 754 Subjects?	Taxonomy Level Which Subjects Could Classify	How Many Subjects Recognized Only the Taxonomy Level?	How Many of the 754 Subjects Did Not Recognize the Plant Species by Specific Name Either?
Betula pendula (silver birch)	135 (17.9%)	Birch	390 (51.7%)	229 (30.4%)
Pteridium aquilinum (bracken)	39 (5.2%)	Fern	384 (50.8%)	332 (44.0%)
Dicranum polysetum (dicranum)	36 (4.8%)	Moss	201 (26.7%)	517 68.6%)
A. incana (grey alder)	23 (30.1%)	Alder	197 (26.1%)	534 (70.8%)
F. vesca (wood strawberry)	613 (81.3%)	Strawberry	116 (15.4%)	25 (3.3%)
Eriophorum vaginatum (cotton grass)	45 (6.0%)	Cotton/grass	61 (8.1%)	648 (85.9%)

3.3. Which Variables Explain Plant Species Recognition Statistically Significantly: (a) Sex, (b) Age, (c) School Grade/Level, (d) Living Place, or (e) School?

Girls recognized plant species better than boys. The difference between the sexes is statistically very significant in every test group ($F(1.752) = 191.801$, $p = 0.000$) other than between teacher students, primary school teachers, and university teachers, because the number of boys was too low and the result was not reliable (Table 6). Sex explained 46% of the species recognition skills. Girls (N = 459) recognized on average 29 plant species and 35 taxonomy levels. Boys (N = 295) recognized 19 plant species and 23 taxonomy levels (Table 7).

Table 6. Results from ANOVA tests.

		Sum of Squares	df	Mean Square	F	Sig.
Sum 1	Between groups	18,091.919	1	18,091.919	191.801	0.000
	Within groups	70,933.356	752	94.326		
	Total	89,025.275	753			
Sum 2	Between groups	26,472.692	1	26,472.692	217.459	0.000
	Within groups	91,545.941	752	121.737		
	Total	118,018.6	753			

Notes: [a] Sum 1 = specific plant species from 70 test species, [b] Sum 2 = how many taxonomy levels from 70 test plant species.

Table 7. Differences between the sexes (N = 754) in the plant species recognition test.

Species Recognition Test						
Sum	Sex [c]	N	min [d]	max [e]	mean [f]	standard [g]
Sum 1. Specific names [a]	Boys	295	0	65	19	8.1
	Girls	459	6	70	29	10.62
Sum2. Taxonomical names [b]	Boys	295	0	69	23	9.27
	Girls	459	7	70	35	12.03

Notes: [a] Sum 1 = specific plant species from 70 test species, [b] Sum 2 = how many taxonomy levels from 70 test plant species, [c] Sex = 0 = boy, 1 = girl, [d] minimum score of 70 tested plant species, [e] maximum score of 70 tested plant species, [f] mean = mean is rounded to an integer, [g] the standard deviation.

Subjects were students from primary school to high school, teacher education students, primary school teachers, and university teachers (N = 754), were aged between 6 and 65, and as noted earlier, recognition skills improved with age. There is a statistically significant difference between ages of pupils from primary school only (grades 1–6) ($F(5.186) = 3.670$, $p = 0.003$Additionally, if the data are analyzed between all subjects, it can be found that age and the corresponding school grade explain plant species recognition as being statistically very significant $F(13.740) = 38.664$, $p = 0.000$).

Place of residence and school were researched between primary school sixth grades (age 12–13), because there were schools from both cities and the countryside. There were two sixth grade classes each from of the city and from the country. The influence of the living place and school on species recognition skills was statistically very significant $F(1.164) = 15.777$, $p = 0.000$). Pupils from the country recognized plant species better (26 plants on average) than pupils from city (21 plants on average). Place of residence explained 9% of species recognition, species recognition 9%, sex 20%, and age 5% (Table 8).

Table 8. To what extent is the available explanatory variable explained by the number of identified plant species in the plant species recognition test?

Explanatory Variable	Regression/Dependent Variable	[a] r	Coefficient of Determination	[b] p
Place of residence/school (six classes/grades from country side and from city)	Plant species recognized	0.296	0.0877 ~ 0.09 = 9%	0.000
Sex (girl/boy)	Plant species recognized	0.451	0.203 ~ 0.20 = 20%	0.000
Age/grade (from 6 to 65, primary school to university experts)	Plant species recognized	0.227	0.0513 ~ 0.05 = 5%	0.000

Notes: [a] r = correlation coefficient, [b] p = statistical significance.

4. Discussion

The results suggest that neither Finnish students nor even all teachers recognize plant species very well, with wide variations between answers. The better subjects could recognize plant species well, but there were also subjects whose recognition of even the most common plant species was weak. Species recognition skills improved from primary school to university teachers. Sex and place of residence were among the factors that could explain species recognition skills—girls and pupils from rural areas knew plant species significantly better than boys or pupils from cities. Could it be that that the teaching methods advantages girls more? This point requires more investigation. In rural areas, plants can be more visible than in the cities and it is possible that pupils from rural areas have more daily connections to plant species than pupils from cities.

Plant species that were well recognized are species with which pupils probably have many connections, with memories of them based on several senses. Raspberry and bilberry are good examples. Finnish pupils are more likely to have picked berries in the woods: Having searched, found, collected, tasted, and stored them. Moments like these make plant species easier to remember. Species that are not well known but might be common probably do not have clear identification marks (like *L. pilosa*), and may not have any special meaning to the pupils. If someone has never seen a plant species in nature, or no one has told them to look for that plant species there and told them that its name is hairy wood rush, it is possible that pupils will not have even noticed that species. It would be also interesting to research more whether the context information helps identification. For example in this research there were pictures, where you can see plant species with the growing place, example, *Nuphar lutea* in a pond. However, berries were well recognized even when the context was not very visible.

This research focused only on knowledge tasks, but as we know, the concept of plant blindness is multidimensional. This phenomenon should be studied much more widely and should mirror the results to define the concept. It would also be important to have an international overview about plant blindness. In general, Finland has been at the top of education rankings, but currently we do not know if these results reflect the situation in other countries. Are Finnish students still performing better than students from other countries?

5. Conclusions

This study supports the concept of "plant blindness", because plant species recognition skills seems to be poor in Finland also. Even though there are limitations in this research, with its narrow scope of recognition of 70 plant species, in this time of global environmental problems, we should take this result seriously. Plants are among Earth's key elements, and we are totally dependent upon them. We are in a situation in which we have to think how we could increase the knowledge and appreciation of plant species. Even though it is hard to say what is an appropriate knowledge of plant species, or how many of them people should recognize, guidelines could be that pupils should know the most common plant species in their own place of residence, know how to find more information about plants, and understand why plant species are important. Then we could deal with the many dimensions of plant blindness. The national curriculum is an important starting point. Plant species recognition is mentioned in the new Finnish curriculum [50]. Every pupil must collect plants from nature and make a herbarium. This is excellent, because then pupils have to go out. It seems that the best way to learn about species and biodiversity is to go into nature to see real species, where the use of different senses should help pupils to learn more. Going outdoors also has many other positive effects, as noted earlier.

There has been little evidence-based research to provide ideas and advice on how to teach about plant species [4,51–53]. Pany [4] and Pany and Heidinger [54] suggest that plant species recognition should be taught by starting with plant groups that are interesting to students. That is because of Deci and Ryan's (2008) self-determination theory of motivation: When someone considers an object to be interesting, cognitive learning is worth an effort and it develops intrinsic motivation [55]. Interesting plant groups include edible, poisonous, medical, and herbal plants [4]. It is evident that plant species recognition education is needed. Perceptions of biodiversity of knowledge about species are key elements we want to increase in pupils' awareness of the environment. When someone is connected to nature, they can love it, protect it, and take care of it. These results should encourage teaching about plant species while out in nature, using the senses and teaching methods at schools, but also with families.

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Conflicts of Interest: The author declares no conflict of interest.

Appendix A

1. *Pinus sylvestris*, Pine, 2. *Picea abies*, Spruce, 3. *Juniperus communis*, Juniper, 4. *Betula pendula*, Silver birch, 5. *Sorbus aucuparia*, Rowan, 6. *Populus tremula*, Aspen, 7. *Alnus incana*, Grey alder, 8. *Acer platanoides*, Norway maple, 9. *Prunus padus*, Bird cherry, 10. *Daphne mezereum*, Daphne, 11. *Calluna vulgaris*, Scotch heather, 12. *Rhododendron tomentosum*, Labrador-tea, 13. *Empetrum nigrum*, Curlewberry/Black crowberry, 14. *Viola riviniana*, Common violet, 15. *Hepatica nobilis*, Common Liverwort/Liverleaf, 16. *Anemone nemorosa*, European wood anemone, 17. *Anemone vernalis*, Pale Pasque-flower, 18. *Trientalis europaea*, European starflower/Chickweed wintergreen, 19. *Tussilago farfara*, Coltsfoot, 20. *Taraxacum* sp., Dandelion, 21. *Ranunculus acris*, Meadow/Common buttercup, 22. *Leucanthemum vulgare*, Ox-eye-daisy, 23. *Achillea millefolium*, Milfoil/Common yarrow, 24. *Achillea ptarmica*, Sneezeweed, 25. *Oxalis acetosella*, Wood sorrel, 26. *Maianthemum bifolium*, May lily/Wild lily of the valley, 27. *Trifolium repens*, White clover, 28. *Trifolium pratense*, Red clover, 29. *Solidago virgaurea*, Goldenrod, 30. *Epilobium angustifolium*, Fire weed, 31. *Geranium sylvaticum*, Wood cranesbill, 32. *Dactylorhiza maculata*, Spotted orchid, 33. *Tanacetum vulgare*, Tansy, 34. *Anthriscus sylvestris*, Cow-parsley, 35. *Urtica dioica*, Common/Annual nettle, 36. *Filipendula ulmaria*, Queen-of-the-meadow, 37. *Melampyrum pratense*, Cow-wheat, 38. *Galeopsis speciosa* Hemp-nettle, 39. *Lathyrus pratensis*, Yellow vetchling, 40. *Vicia cracca*, Tufted vetch, 41. *Campanula rotundifolia*, Harebell, 42. *Campanula patula*, Spreading bellflower, 43. *Convallaria majalis*, Lily-of-the-valley, 44. *Veronica chamaedrys*, Bird'seye/Germander speedwell, 45. *Eriophorum vaginatum*, Cotton grass, 46. *Alchemilla* sp. Wrinkle leaf/Lady's mantle, 47. *Pteridium aquilinum*, Bracken, 48. *Plantago major*, Greater plantain, 49. *Matricaria matricarioides*, Pineapple mayweed, 50. *Equisetum sylvaticum*, Wood-horsetail, 51. *Luzula pilosa*, Hairy wood rush, 52. *Phleum pratense*, Timothy grass, 53. *Artemisia vulgaris*, Common mugwort, 54. *Rubus idaeus*, Raspberry, 55. *Vaccinium myrtillus*, Blueberry/Bilberry, 56. *Vaccinium vitis-idaea*, Rock-cranberry/Cowberry, 57. *Fragaria vesca*, Wood strawberry, 58. *Rubus chamaemorus*, Baked-apple-berry/Cloudberry, 59. *Vaccinium oxycoccos*, Cranberry, 60. *Schoenoplectus lacustris*, Bulrush, 61. *Phragmites australis*, Common reed, 62. *Nymphaea alba/candida*, White water-lily, 63. *Nuphar lutea*, Yellow Nelumbo/Water-Cinquapin/Yellow water-lily, 64. *Caltha palustris*, King's cup/Cowslip,

65. *Dicranum polysetum*, Dicranum, 66. *Hylocomium splendens*, Glittering feather moss, 67. *Cladonia stellaris*, Ball/tot reindeer moss, 68. *Cetraria islandica*, Iceland moss/lichen, 69. *Usnea filipendula*, Beard moss/lichen, 70. *Linaria vulgaris*, Butter-and-eggs/Common toadflax.

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